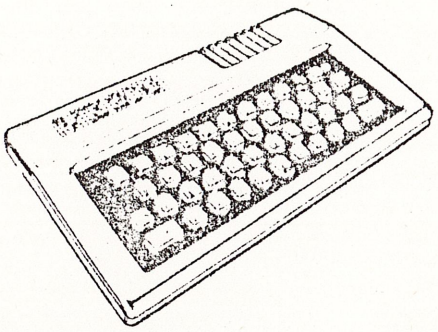

Radio Teletype with the Dick Smith VZ-200 Microcomputer

by ROSS KEATINGE, ZL1BNV

About a year ago I was contemplating the purchase of a second microcomputer for the ham shack to be dedicated to radio activities and leaving the present machine (a System-80) available for general computing and development purposes. The requirements were for something compact but with a useable keyboard, the facility to use machine code if required and most important for radio activities, freedom from RF noise generation. This latter point had been a problem with the System-80 on what was otherwise a good all-round machine. The VZ-200 had just been released and seemed to fit the bill nicely. Bringing one home on trial brought the pleasant surprise of using a machine which was spectrally inaudible when running beside an HF receiver.

After getting over the novelty of being able to draw coloured lines on a television, it was time to get down to the job of getting it going for its intended use, namely RTTY. The first problem was to decide on a method of getting the RTTY signals in and out of the computer. One method considered was to use the expansion bus connection and build a serial I/O port using a UART chip for the parallel/serial conversion. The advantage of this method was that much of the software could then be written in BASIC using a simple INP or OUT instruction to send data to, or get data from, the serial port. The disadvantages were the possiblity of RF noise due to the bus being extended outside the computer case and the extra circuitry needed, especially if a variety of baud rates were required. Previous experience led me away from this option. The other possibility was to use the cassette port and machine code software to produce the serial signals. This method was adopted and several advantages became apparent. No expensive edge connector was required, baud rates could be changed easily in software and no other functions of the computer were affected. The circuitry required for this type of interface is considerably simpler than the "standard" type of interface using UARTs with their associated baud rate generators, etc. The interface described here has only three integrated circuits.

Having decided on this method, another problem emerged. There was a requirement for an efficient method of writing machine code for the VZ-200 for which there is no assembler available. The trusty System-80 was pushed into use along with the Microsoft Editor/Assembler package. Software was developed to enable the VZ-200 to load machine code tapes produced by the System-80 and to convert these into VZ-200 format.

The output side of the VZ-200 cassette port is DC coupled with about 200 mV output when programmed high and close to ground when low. A simple comparator is therefore all that is required to convert this to a standard logic signal. The input side is AC coupled so therefore cannot be used directly to detect a logic level. It can, however, be used to detect whether or not an audio tone is present. Therefore by using the logic signal to gate an audio tone on and off, software could read the state of the logic. This method is easily implemented because the audio tone from the AFSK generator can be used for this purpose.

After some experimentation, the circuit of Figure 1 was devised. The XR-2211 was used as a simple and effective means of converting the received mark and space tones to logic levels. The XR-2206 was chosen as the AFSK generator, the output of which is also used in the receive process described above. A Tx/Rx control line

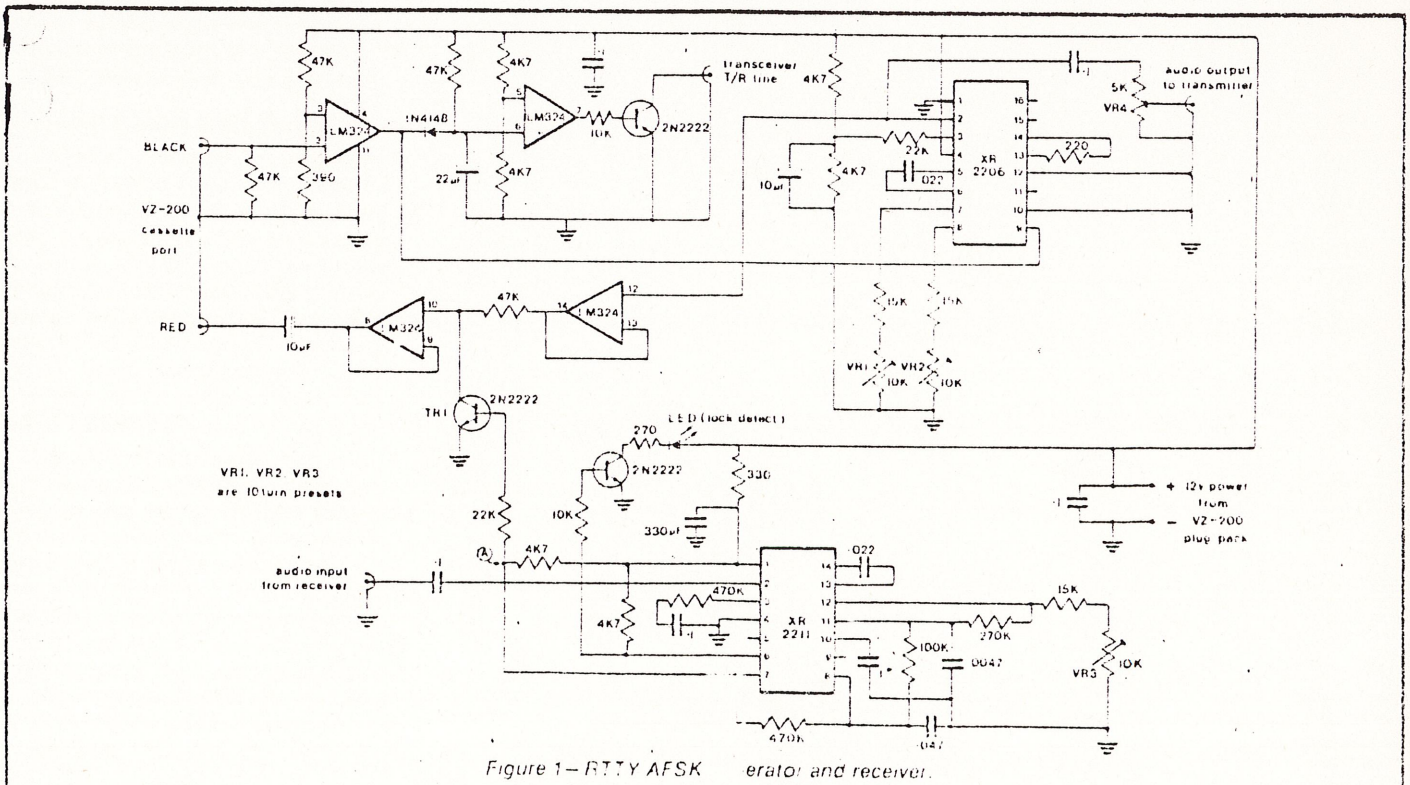

Figure 1 – RTTY AFSK generator and receiver.

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for the transceiver is derived from a monostable which switches to transmit when a space condition is sent from the computer and times out after about half a second of constant mark signal. The component values given here have been calculated for the standard amateur tone frequencies of 2125 Hz mark and 2295 Hz space. Those who wish to experiment further are referred to the data on the XR-2211 and XR-2206 available from the agents (Professional Electronics Ltd).

A considerable number of hours were spent developing and modifying the software which in its final form consists of about 1300 lines of Z80 assembler code. It produces about 2.5 kilobytes of machine code when loaded into the VZ-200. The program incorporates the following features:

—split screen display for transmit and receive.
—fully buffered keyboard with 1000 character buffer.
—nine message memories which can be saved on cassette along with the program.
—baud rate keyboard selectable from 45 to 99 baud.
—ability to type in transmit text while still receiving.
—selectable line length on transmit with no breaking of transmitted words.
—both transmit and receive text able to be sent to line printer.
—runs on a standard machine without extra memory.

These features have been selected as being the most useful of the wide range of possibilities available. Users have found the system to be very "friendly" and as good as most commercial packages available for other machines.

Since the program source code cannot be entered and used on a VZ-200, it is not reproduced here. The author will make the machine code available in the form of a standard VZ-200 cassette (see details below).

Construction and Adjustment

The only important construction detail is that the circuit should be built in a grounded metal case to prevent RF from the station transmitter causing problems. The circuit can be simply constructed on copper strip matrix board. Perhaps someone with a flair for artwork will come up with a printed circuit board. The power for the interface can be obtained from the VZ-200 plug pack.

Adjustment is a simple matter of setting the frequencies of the PLL decoder and the AFSK tone generator. To do this a program was written to make the VZ-200 behave like a frequency counter. This is included on the tape containing the main program. The following steps should be followed:

1 Disconnect the collector of TR1. This ensures that the computer is receiving the audio tones from the XR-2206.
2 Load and run the frequency counter program then connect the cassette cables from the VZ-200 to the appropriate connectors on the interface.
3 At this stage the screen should be showing the mark frequency.
4 Adjust VR1 for a frequency of 2210 Hz. This is halfway between the standard frequencies of 2125 Hz and 2295 Hz.
5 Connect the interface input into its audio output. Adjust VR3 for the centre of its lock range as indicated by the lock detect LED.
6 Now adjust VR1 for 2125 Hz, this sets the mark frequency.
7 Press S. The computer now shows the space frequency. Adjust VR2 for a frequency of 2295 Hz.
8 Reconnect the collector of TR1.

This completes the calibration process.

Operation

The XR-2211 works with an input level of between 2 mV and 3 V RMS. If your receiver does not have a low level audio output, a suitable signal can usually be obtained from the top of the AF gain control. Alternatively, the speaker signal can be used but this has the disadvantage of being dependent on the AF gain control. Trimpot VR4 adjusts the audio output level of the interface. A maximum of about 2 V RMS is available. Remember to stay within the continuous power limitations of your transceiver.

The system has been in use for several months now and has given good results on both HF and 144 MHz FM. The operation on HF is achieved by transmitting the audio output of the interface on lower sideband, producing normal FSK. If the transceiver has a direct FSK input available, then this could be driven from the logic signal of pin 1 of IC1. If this is done, remember that the audio tone from the XR-2206 is still required in the receive circuitry. The PLL decoder will decode weak signals well but can be affected by strong interfering signals within the passband. The IF shift on some transceivers can be used to good advantage to reduce interference. If a good quality FSK decoder is already available, it could be used by applying its logic output to TR1 at point A instead of the XR-2211 signal. It should produce a logic high (i.e., turn TR1 on) when the low frequency mark tone is detected.

Overall it has been an interesting project and has enabled several people to enjoy another facet of our hobby without great expense. See you on the screen!

A cassette containing both the main RTTY program and the frequency counter program together with a five page instruction booklet can be obtained from the author at a cost of $15.00 (including p & p).

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